SYNOPSIS

On Thesis Entitled

"Some Special Types of Statistical Quality Control Charts for Variables under the Assumption of Moderateness"

By

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Introduction:

In every branch related with business and industry, there is a competition. Different manufacturers put the same type of product in the market as per the demand of the consumers. The manufacturer has to ensure that his products always compete with other products from the view point of quality and price and so the manufacturer has to strive continuously to maintain quality standards of his products. Hence one of the primary needs of the top management in any organization is to ensure that the product manufactured by them is of optimum quality. To achieve the optimum quality of a product at desired level and at as low the cost of production as possible, the technique of quality control is used. The technique of quality control is a continuous process in which the need for action is identified at the earliest possible stage.

There are so many new techniques which have been developed to control the quality of the products. In the field of manufacturing products the statistical methods are also applied for maintaining the standards of quality of the products. The technique of using the statistical methods for maintaining the standards of quality and improving it by implementing modifications there too, is known as a Statistical Quality Control.(S.Q.C). The role of Statistical Quality Control (S.Q.C.) is to collect and analyze relevant data for the purpose of detecting whether the process is under control or not. If, not what can possibly be the reason for the lack of control.

To control a process using data on a variable of the product, it is necessary to keep a watch on the current state of the accuracy (central tendency) and variation (spread) in the data of the variable. This may be achieved with the aid of the control chart known as variable control charts. A control chart is a graphical device of the representation of the data for knowing the extent of variations from the expected standard. The use of control charts can provide more information about a process than workers with years of experience. A powerful combination is formed when experienced workers use the control charts, because the charts indicate when a source of variation occurs, the chart patterns provide hints to the causes of variation, and the workers can use the hints along with their experience to identify the source of the variation problem and eliminate it.

Orientation to the research topics considered in the thesis:

A fundamental assumption in the development of $\bar{X}$, R and s charts is that the underlying distribution of the quality characteristic is **normal**. The normal distribution is one of the most important distributions in the statistical inference in which mean (μ) and standard deviation (σ) are the pivotal parameters of this distribution. Several authors have studied the effect of departures from normality on control charts. Burr (1967) has noted that the usual normal theory control limit constants are very robust to the normality assumption and can be employed unless the population is extremely nonnormal. Schilling and Nelson (1976), Chan, Hapuarachchi, and Macpherson (1988), and Yourstone and Zimmer (1992) have also studied the effect of nonnormality on the control limits of the $\bar{X}$ chart. Schilling and Nelson investigated the uniform, right triangular, gamma and two bimodal distributions formed as mixtures of two normal distributions. Their study indicates that, in most cases, samples of size four or five are sufficient to ensure reasonable robustness to the normality assumption.

Naik and Desai (2011) have suggested an alternative of normal distribution, which is called moderate distribution. In moderate distribution mean (μ) and mean deviation (δ) are the pivotal parameter and, which has properties similar to normal distribution. Under this statistical model with different values of μ and δ, one gets different moderate distributions. All moderate distributions are symmetric and bell-shaped. Naik and Desai (2011) have also prepared moderate table (Similar to normal table) pertaining to the area under standard moderate curve. With the help of this table, we can check the significant moderation taking place in the distribution of probability in normal distribution when the dispersion parameter σ (standard deviation) is replaced by another dispersion parameter, δ (mean deviation). For example, in standard normal distribution having K= σ =1, about 3 observations out of 10 are expected to lie outside the range μ ± K whereas in moderate distribution with K=δ =1, about 4 observations out of 10 are expected to lie outside the range μ ± K. Similarly, for normal distribution with K= σ =3, about 27 observations out of 10,000 are expected to lie outside the range μ ±3 K whereas in moderate distribution with K=δ =3, about 167 observations out of 10,000 are expected to lie outside the range μ.± 3K. They have also suggested the central limit theorem based on the mean error of statistic rather than standard error, which is very useful for the construction of the proposed control charts. Keeping these concepts in mind, an attempt will be made to develop the main traditional Shewhart type control charts under the assumption that the underlying distribution of the quality characteristic is moderate.

Control limits are key factor in the quality control charts. Dr.W.A.Shewhart has suggested 3 ×(standard error) control limits when the production process follows normal distribution. It can be seen that in a normal distribution about 99.73% of the observation lie within the interval mean$\pm 3\sigma$. Therefore practically all observations will be within this range. The probability that any observation will fall outside this range is 0.0027 i.e. negligible. We will propose 3×(mean error) control limits in the proposed thesis.

The work of this thesis has originated from such thoughts.

Provisional Lay out of the Thesis to be submitted:

The proposed thesis will be consisted of five chapters. The first chapter will cover general introduction, brief history of Statistical Quality Control and review of literature on topics related to the topics of research. In the second chapter of the thesis basic theory of Statistical Quality Control charts for variable will be reviewed. It will also involve the theory and the formulas of existing control charts for variables under the assumption of normality. Various properties of exiting control charts for variables as well as some merits and demerits of the charts will also be discussed in this chapter. Moderate distribution and some aspects of general theory of control charts under moderate distribution will be discussed in the third chapter. In the chapter four when the production process follows moderate distribution, the main variable Shewhart type control charts will be discussed and their strengths will be analyzed.

While selecting control charts, it is very important to know how effective they are. There are two commonly used methods for comparing control chart performance. The first method is to determine the charts operating characteristic (OC) curve. The second is to determine the average run length (ARL). In fifth chapter an attempt will be made to measure the effectiveness of the control charts that were discussed in the fourth chapter using these two methods. Appendices and References will be given at the end of the thesis.

Reference:

1. Douglas C. Montgomery (2007), “Introduction to Statistical Quality Control”, John Wiley India (p), Inc, New Delhi.
2. E.G.Schiling and P.R.Nelson (1976), “The Effect of Nonnormality on the Control Limits of $\bar{X}$ Charts”, Journal of Quality Technology, Vol.8.

3. I.J.Burr (1967), “The Effect of Nonnormality on Constants for $\bar{X}$ and R Charts”, Industrial Quality Control, Vol.23.
4. પ્રો.ર.ટી.રતાણી (1991), “આંકડાશાસ્ત્રીય ગુણવત્તા નિયંત્રણ”, યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ, અમદાવાદ.
5. V.D.Naik and J.M.Desai (2011): “Alternatives of Normal Distribution and its related Distributions in which Mean and Mean Deviation are the Pivotal Parameters and Their Application”, PhD thesis submitted to Veer Narmad South Gujarat University, Surat.

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